

The AMSAT[®] Journal

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Field Day 2003

Top - (left) Ron Sparks, AG5RS, and (right) Jerry Brown, K5OE operate Field Day.
Middle - (left) Satellite antenna at the KC0AHN site; (right) Dish at the W1PA site.
Bottom - (left) When the F_2 layer goes to the dogs, the smart ones switch to satellite;
(right) Operating through the night at W1PA.

[Field Day coverage begins on page 17]

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Apogee View

By Richard M. Hambly W2GPS
AMSAT-NA Executive
Vice President

2003 Symposium and Volunteers

By the time you read this you may be preparing to leave for Toronto and the 2003 Space Symposium and Annual Meeting, or perhaps you are already there. This year's meeting is shaping up to be a very exciting one, so if you have been thinking of attending, this is the year to come. AMSAT-NA is nearing completion of AO-E ("Echo"), its first satellite in over a decade. AMSAT-NA and AMSAT-DL are both designing high orbit satellites ("Eagle and P3E"). I expect we will be hearing encouraging words about these projects during the symposium. We will also be hearing about other satellites, operations, antenna designs, software defined radios, ARISS and an exciting new transponder idea for C-Band. If you are unable to make it to the Symposium you might want to call Martha at the AMSAT office and place an order for the Proceedings. The Proceedings are published in time for the meeting so Martha will be able to ship yours as soon as she gets back from Toronto.

On the political front, with the retirement of Dick Daniels, W4PUJ, and Bill Tynan, W3XO, from the Board of Directors we will have some new members and alternates on the AMSAT Board this year. This year's election was the most interesting and hotly contended in AMSAT history. Candidates took advantage of every possible way to reach voters including the amsat-bb mailing list, the AMSAT nets, the EchoLink AMSAT conference channel, and direct mail. This generated a flurry of responses from members, both positive and negative. I saw all of this as a sign that the AMSAT membership is alive and well and that there are still members willing and able to give up a significant part of their personal lives to serve our organization. I hope each of you will take the time to meet and get to know your Board members. Don't forget that most of the Board meeting is open to the membership. It starts after the Symposium on Sunday afternoon and runs through Monday morning. Why not stay an extra day and participate?

As you can tell I am looking forward to this year's Symposium. It seems like only

yesterday that we were at the 2002 Symposium and annual Board meeting in Fort Worth Texas. This past year has been my first as an AMSAT officer and it has been very rewarding, although I had no idea at the time just how much work comes with the appointment. Unfortunately that means some trade-offs had to be made. For example, I have been working with Dave Bern, W2LNX, to build an AMSAT transportable station with equipment that will eventually become part of an AMSAT satellite test station. At the same time I have filled my garage with new antennas, rotors, cross-booms and other parts, but they are not yet on the roof. Time ... if only there was more time...

This coming year has every indication of being even more demanding and exciting. Our new Board members will bring new ideas and renewed enthusiasm. There will be the excitement of Echo's launch in the spring. We will establish campaigns to get AMSAT back on a sound financial footing. We will need to strengthen our strategic view of the future and match it with our fiscal realities. We will try to get the Eagle satellite project back on track. We will face important regulatory issues, some as a result of changes made at the to the international radio regulations at the recently concluded World Radiocommunication Conference.

I am often asked "How can I help?" The answer to that is different for each individual. At a minimum, renew your membership and encourage others to do the same. I have read many messages on amsat-bb from non-members. Over two thirds of the people who have e-mail aliases in the amsat.org domain are non-members. Let's get all these people on the roles. Bring membership forms to your local and regional club meetings, to hamfests, and to contest sites. Wear your AMSAT shirts to these meetings with pride. Join the President's Club for as little as \$0.33 a day.

For more of a personal contribution you can contact Barry Baines, WD4ASW, AMSAT VP for Field Operations and sign up as an Area Coordinator. You can volunteer to host the AMSAT table at a hamfest or just volunteer to relieve someone for an hour at a hamfest table. If you have portable satellite communications capability take your station to a club meeting, hamfest, school, or other event and show others the excitement of

Continued on Page 31

What is AMSAT®?

AMSAT Members are a worldwide group of enthusiastic individuals designing, building, and operating amateur radio satellites as part of our program of space science education. The Radio Amateur Satellite Corporation (AMSAT or AMSAT-NA) is a non-profit scientific and educational organization chartered in Washington, DC, in 1969. Since then, AMSAT and colleague organizations around the world have built over 50 ham radio satellites. 15 of these satellites continue in operation. Joining AMSAT supports our current projects: Eagle, AMSAT-OSCAR-E (Echo), and ARISS. Eagle is a high orbit DX capable satellite planned for a 2007 launch; Echo is a low orbit FM and digital bird you will be able to use with simple equipment, planned for launch in 2004; and ARISS is our program on the International Space Station. You will keep up to date on the world of amateur radio satellites with 6 issues of the AMSAT Journal every year.



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(above) A sample of the AMSAT Membership QSL Insert

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You can find the QSL inserts on-line at <http://www.amsat.org/amsat/amsat-na/membership.html> ■

(right) Rick Hambly, W2GPS, AMSAT Executive VP, shown viewing the AMSAT QSL insert.





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Recent Events on AO-40

By Reinhard Richter, DJ1KM

Translation: John J. Bubbers, W1GYD

(This article first appeared in the AMSAT-DL Journal of June/August 2003)

RUDAK operation was completely shut down temporarily after the sun angle slowly became poorer at the beginning of February, 2003. Simultaneously, K-band operation was activated between MA124 and 134, and the beacon was turned on during the complete orbit.

The ALON/ALAT values were changed to adapt to the sun angle, and thereby the MA values with favorable squint angles were increased. The passband was then up to MA230. On the 23rd of February the first test of the S-band receiver was performed. Since the S2-band transmitter blocks the S-band receiver, the K-band transmitter was put into operation for the transmission of the signal. Based on a request by W4SM, several stations prepared for this test over a two-week time period. These were W4SM (command), N1JEZ (K-band receive), I8CVS (S1Transmit) and G3WDG (S1transmit/K-band receive). The test began with 2 MA period on with S-band and K-band beacons to orient the antennas and to locate the signals. The S1 receiver was connected to the S-band antenna and after intensive testing it was established that the S1 receiver operated perfectly. The entire story can be read in English on http://www.g3wdg.freeonline.co.uk/s_ktest.htm page.

At the beginning of March 2003 the ALON value was increased and simultaneously the MA values were moved upwards along with the squint angles. The K-window was also moved to higher MA values. The passband was widened out to MA240, which led to surprising operational opportunities. Not only was the squint angle low, but the range to the satellite was also low and was only 25,000 km. The transmitter power couldn't be turned down enough so that the signal didn't arrive at the satellite too strong. L-band stations were observed that transmitted with 3 to 5 watts and produced a very strong signal in spite of it. It became very clear that the distance to the satellite has a significant influence on the signal strengths.

In the month of March the ALON was moved to 45 degrees and at the beginning of April the ALON/ALAT = 45/20 was reached, and

the passband was finally turned off during Orbit 1134 at MA 240.

The satellite was allowed to drift for about a month until the middle of May 2003 when it reached ALON/ALAT = 315/20. ALAT was then reduced to 0, allowing the passband to be turned on again. Passband operation was moved to the beginning of the orbit.

The lower MA values created favorable squint angles and similarly permitted good operating conditions, similar to the high MA values before the shutdown. The satellite was then moved backwards toward ALON = 0 at about 1 degree per day as it followed the sun. About June 20th ALON/ALAT = 0/0 was reached with its favorable squint angles around the apogee. The satellite's orientation will then remain there until the beginning of October 2003, when the situation begins anew.

It has to be made clear that the command stations constantly check the orientation of the satellite and must control it accordingly. Even when a certain ALON/ALAT value is held constant for a longer period the command station, in this case W4SM, has to correct the orientation nearly daily with the aid of the magnetorquer in order to reach the desired ALON/ALAT value. The orienting follows with the help of the Yace camera, as described in the previous article. The regular correction is necessary because of the so-called mystery effect, which changes the orientation of the satellite. We now know that the permanent magnets of the reaction wheels that function along with the earth's magnetic field change the orientation. The question has recently been expressed, as to why the 3-axis stabilization has been ignored, as it was originally planned. This matter was discussed on the AMSAT-BB at the beginning of April, and I will briefly repeat the discussion here.

Someone asked, what has happened to the transition to the 3-axis stabilization. Possibly he had seen the last report on this matter on the AMSAT-DL pages, which contained a detailed plan to proceed gradually beginning in November 2002, when the conditions would be favorable. Since then he has heard nothing. Jon Ogden, NA9D, answered him,

that the "pucker" factor was very high for the 3-axis stabilization. There are very high risks involved. The software algorithm for the current orbit is very different than for the originally planned orbit. Furthermore, we don't know how the mystery effect will influence the 3-axis stabilization. Can the reaction wheels compensate for it? Additionally, we don't know how much total damage resulted from the explosion and whether the functioning components will still operate. The reaction wheels have indeed been tested, but in spite of it we still don't know whether they haven't experienced some further damage. Other components had performed earlier and then failed, for instance, the S1 transmitter.

When the Eagle and P3-E projects are both in orbit such tests can be undertaken. If we lose OSCAR-40 there are other satellites that can be used. But if we lose AO-40 now, we will not have an operational high altitude satellite. The way Jon understood it, the solar panels have to be deployed if the reaction wheels are to be operated. Only then, presumably, can the remaining torque be absorbed. If the panels are deployed we cannot return to spin stabilization as it now operates. If we then deploy the panels and the 3-axis stabilization is begun and it doesn't work, we will have a serious problem. Stacey (W4SM) is to have said at one time, that we would then operate only with a very low rotational speed, but will this work? Beyond that, there are no advantages nor additional operational possibilities if the panels are deployed. Moreover, there is little additional advantage. This information was supplied by NA9D.

Stacey Mills, W4SM, took the following position. He had not occupied himself with this subject for some time, since there was nothing tangible. As he remembered some time ago a method had been developed, as to how the 3-axis stabilization could be tested without deploying the solar panels. If this proceeds unsatisfactorily, one could return to the spin-mode. However, these decisions have not fully developed, and the necessary, critical software has not yet been tested in practice. Additionally, the command team

is in no hurry to explore this area for reasons which were presented by NA9D. There is a legitimate concern whether we might destroy our only high-flying, functioning satellite. There is in addition a whole host of commitments to be solved, standard time test of the telemetry, perfecting the orientation control of the satellite, etc. It had been hoped that greater progress would have been made over the winter, but two command stations were unable to participate. Decisions were questioned as to whether one was sufficiently equipped if problems arose. Added to this is the pressure of the planning for the new satellites, P3-E and P5-A in consideration of the IHU, software development, etc. These assignments are schedule dependent and take time which otherwise would be available for 3-axis control.

It should not be said that 3-axis stabilization is no longer in the plan, but there is no pressure to pursue this matter before adequate time is available. First critical software for the magnetorquer has to be tested. This function must be determined reliable and must be dependable when the time comes. This plan does not have the alternative to abandon the spin mode, rather to reduce the spin rate so that the orientation control stills functions and the effect of mystery effect can be compensated. Better pictures from the SCOPE-camera would be a secondary effect (less out of focus). If that function is viable, the opportunity for 3-axis stabilization can become feasible. If, however, we can't correct for the mystery effect at a low spin rate, the approach will be abandoned completely.

The strongest argument for doing the 3-axis stabilization is that the satellite was developed for this mode and a large expenditure was put into the development of the reaction wheels and the 3-axis sensors. For future missions it would be excellent if we could confirm that the concept works. It would certainly be advantageous for the satellite user, but not to the degree, that if when the planned inclination had been reached and there were more operating transmitters on board. It is important to remember that the 3-axis stabilization system cannot eliminate the poor seasonal sun angles on the current orbital path. This is the opinion of W4SM.

The AO-40 team is happy about the increasing popularity of the satellite, and new stations are added daily. Reinhard (Hardy), DC8TS reported briefly about the activity as follows: "Above and beyond the

[current activity] the increasing activity indicates that vacation-style operation (FG/W9AE, FM/F6BC) and DXpeditions (XR6M), VP6DIA) have chosen AO-40 as the operationally more frequently used satellite. In the week after Easter, T7/DL0HUN was operational on all possible satellites. Unfortunately AO-40 was already turned off. VK9X and VK9C have planned some activity for October. We hope that all develops as the hams have planned."

Meanwhile, my highlights in recent times include 8JIRF, VP6DIA, A22BP, 5N0EVR, apart from KL7 and KH6, who could not be worked. Ducie Island, VP6DIA, is my only new "entity". Exciting days are ahead of us. CU on AO-40! ■

How to Save and Post-process AO-40 FEC Telemetry

By Kazu Sakamoto JJ1WTK

During the afternoon of June 7th 2003, while I was watching the AO-40 telemetry on the S2 beacon, I noticed that my 400bpsPSK Phase3 Data demodulator¹⁾ seemed to be running but showed some strange behavior. It locked in the signal, and the sound was normal, however, the telemetry program P3T²⁾ displayed nothing. When I saw the waterfall pattern of the signal with AO40Rcv³⁾, I was sure that this was an experimental transmission of FEC (Forward Error Correction) coded downlink from the AO-40^{4,5)}. The FEC coded block and the other regular (i.e. non FEC) block show the different shapes in the waterfall window. It's easy to see the difference between them on the display.

However, I wasn't ready to decode the FEC blocks in hand then, I decided to save the signal as a .wav file in expectation that I could do it later. Therefore, I will describe in this article my approach to saving the sound files and post-processing them to retrieve the FEC coded telemetry blocks from the saved files. The files are placed on my web page⁶⁾. Thus, you can obtain them and follow the procedure below.

Hardware and software

Here's my hardware and software used in this article.

Hardware:

1. antenna and receiver: 60cm dish for S band with Az-El motor system, down converter

to 2m, coax feeder in 5m and FT-736.

2. demodulator: 400bpsPSK Phase 3 Data Demodulator

3. PC: homebuilt, IDT Winchip2 CPU 233MHz (class i586, MMX), Windows98/Linux.

Software:

1) P3T, AO-40 Telemetry program (for Windows), Ver.1.6e/ 2.0b.

4. AO40Rcv, AO-40 Telemetry decoder (for Windows), Ver.1.40.

5. ao40prototype, AO-40 prototype decoder and library packages(for Linux)⁷⁾, Ver.5.01.

6. phase3d, included in the package of OSCAR 13/40 Telemetry software(for Linux)⁸⁾.

Saving into sound file with AO40Rcv

The AO40Rcv was used to log the sound into .wav files. It provides with the logging function in RIFF format, that is 8000 samples/sec in rate, 16bits in data width and single channel (mono). Select [Output settings] in the menu bar, then check the box [Log Sound to 8000Hz, 16bit Wave File]. I also recommend checking [Timestamp Filename] box. When this is checked, the filename of the .wav file will appear as 1194_030607_120050.wav. It means that the orbit number of AO-40 is 1194, and logging began at 12:00:50 on June 7th 2003 in your PC's time. To include the orbit number, click the [select .wav File] icon and fill in the orbit number like 1194 into [filename(N)] column. Then back to the main window, click [capture on] and click [START]. The .wav file that I logged on June 7th is available on my Web page⁹⁾.

Post processing step 1: Demodulating the logged sound file with ao40prototype and phase3d:

When I began to try retrieve the FEC telemetry block on June, there was no other way of demodulation than the software demodulator in 'ao40prototype' developed by Phil Karn KA9Q which runs on the Linux system. In July that the ADC upgrade kit⁹⁾ for the 400bps PSK Phase 3 demodulator and revised P3T(Ver 2.0 later) became available.

On your Linux system, you need to build the ao40prototype with several library routines. See the README and USAGE files in the package how to build in detail. You will get the command of 'dpsk_demod', 'fec_decode', and 'p3_convert' etc. that the ao40prototype consists.

Here's the basic command usage of ao40prototype to demodulate the logged

sound file. This example assumes that the current directory contains the commands.

```
sox 1194_030607_120050.wav -c 1 -r 9600 -s  
-w -t raw - | ./dpsk_demod -verbose | ./  
fec_decode -verbose | ./p3_convert >  
1194.fec.a
```

'sox' is the 'Sound eXchange'. It's widely used on Linux/Unix system to convert the parameters of sound files like file format, sampling rate etc. In the command above, sox is also used to convert the file format from wav to raw with the parameters which 'dpsk_demod' requires and piped the output into the 'dpsk_demod'.

'p3_convert' is a utility to reconstruct the decoded FEC coded block into a regular 'A' block in 512 bytes. The final output file '1194.fec.a' is now ready to be processed by P3T on Windows. If you wish to see what is contained in '1194.fec.a' on still Linux, you can go further the output of p3_convert to 'phase3d' which developed by Viktor Kudielka, OE1VKW.

Post Processing step 2: Decoding telemetry with P3T:

Now, you need to come back to Windows. At first, for convenience, rename '1194.fec.a' to '1194.raw' to replay in P3T and place the file in P3T's telemetry folder. Start P3T, then use the [Menu] commands in menu bar, and [Replay] commands to specify '1194.raw'.

The disadvantage of logging into sound file is quite plain. It's too large and occupies storage rather than the telemetry block carries actually. On the other hand, the chief advantage is that it is available to post-process as discussed in this article whenever new demodulating techniques are developed later.

Acknowledgements

Viktor Kudielka, OE1VKW's notes¹⁰⁾ were greatly helpful to write this article. Thanks Viktor. The author expresses his gratitude to the AO-40 command team, especially James R Miller, G3RUH for his incentive and encouraging suggestions. And of course the author admires Phil Karn, KA9Q for his proposal of FEC coding.

References

- 1) James R Miller, G3RUH, <http://www.jrmiller.demon.co.uk/products/p3dem.html>
- 2) S. E. Mills, W4SM, <http://www.cstone.net/~w4sm/ham1.html>
- 3) Moe Wheatley, AE4JY, <http://www.qsl.net/ae4jy/ao40rcv.htm>
- 4) Phil Karn, KA9Q, Proposal Coded AO-40 Telemetry Format, <http://www.ka9q.net/papers/>

ao40t1m.html

5) Phil Karn, KA9Q, Proposal for a FEC-Coded AO-40 Telemetry Link, The AMSAT Journal, November/December, p.18-25, 2002 also <http://www.ka9q.net/ao40/2002paper/>

6) Kazu Sakamoto, JJ1WTK, <http://www.jj1wtk.jp/>

7) Phil Karn, KA9Q, <http://www.ka9q.net/ao40/ao40prototype-5.01.tar.gz>

8) Viktor Kudielka, OE1VKW, <http://cacofonix.nt.tuwien.ac.at/~oe1kib/Linux/phase3.tar.gz>

9) James R Miller, <http://www.jrmiller.demon.co.uk/products/p3adc.html>

10) Viktor Kudielka, OE1VKW, <http://cacofonix.nt.tuwien.ac.at/~oe1vkw/fectest/fectest.html> ■



Bill Tynan, AMSAT's Board Chairman gratefully accepts a check for \$500 from Bruce Richardson, W9FZ, Treasurer of the Central States VHF Society while this year's CSVHFS President, Charlie Calhoun, Jr, K5TTT looks on. Over the years the Central States VHF Society has contributed several thousand dollars in support of AMSAT programs.

M2 Advertisement

PC Electronics Advertisement

OSCAR-40 FEC Telemetry

by James Miller G3RUH

Phil Karn KA9Q has long argued that AMSAT should adopt the communication strategies used routinely for several decades by NASA space missions. They have now been implemented experimentally on OSCAR-40 [1]. The results are truly spectacular. Indeed we must surely adopt strong Forward Error Correction (FEC) by default on future missions. This article describes the system, and presents results with AO-40. Using FEC, if you can hear it, it decodes; error-free!

Introduction

All communications channels are subject to errors, whether voice or data. Voice communication usually results in "pardon?" and request for a repeat. Something in the voice message was unclear; maybe a word was obliterated, and the repeat, called an 'automatic request for retransmission' or ARQ, takes care of it.

Data links too have limits, and many strategies exist to deal with them. For example, packet radio links use ARQ; a packet of data contains a checksum, and corruption in transmission is easily detected and a repeat can be requested. But not all links are bi-directional; examples include CDs, digital radio/TV; and spacecraft telemetry systems.

A familiar example is OSCAR-40 400 bps telemetry. Data is sent in 512 byte blocks with a checksum. But if just one bit in the block is corrupted due to noise or spin fading, then the block is useless. A checksum detects the existence of error(s), but nothing can be done to locate or correct them. Thus the telemetry beacon needs to have a very strong signal. This defines the required beacon radiated power and ground station antenna size.

In fact, the simple conventional format of OSCAR-40 telemetry, even when operating at its threshold of performance, demands a signal some 10x stronger than is actually required for error-free communication. See figure 1.

Forward Error Correction FEC

Methods for dealing with errors on one-way data links are called 'forward error correction' or FEC for short. This is achieved by adding redundancy to the data in a prescribed way. The recipient then exploits this additional information to detect and correct errors in the received message. In the Oscar-40 system, 2.5x the original number of bits are sent.

In the AO-40 experiments, only the active 256 bytes of the A-block are processed because it represents all the spacecraft's operational data.

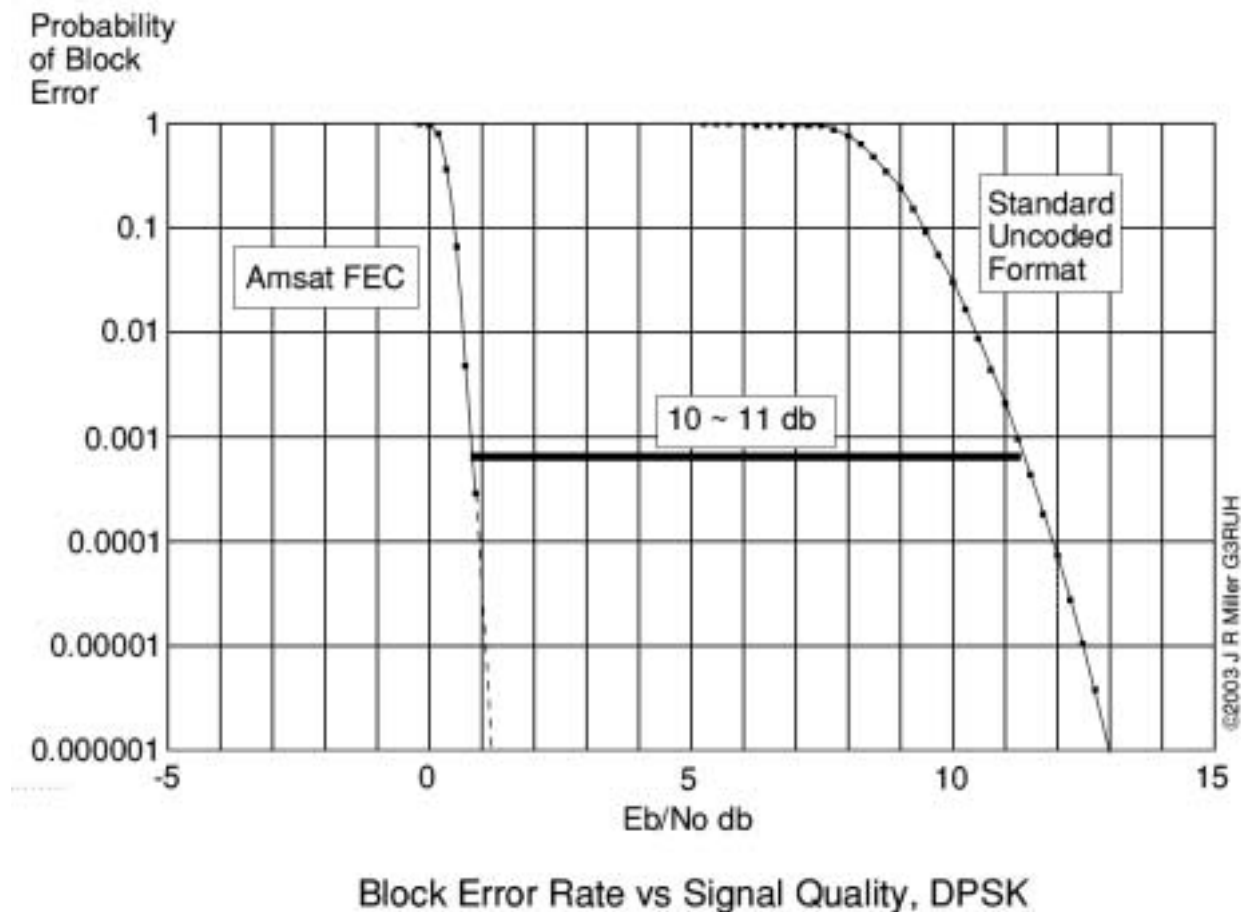


Figure 1. FEC offers some 10 db improvement over conventional AO-40 telemetry. At an Eb/No of 1 db it is barely audible, yet decodes perfectly. Notice the steepness of the FEC plot; 1 db span covers perfection to oblivion.

Performance

Signals from a 60cm dish antenna will provide 100% error free telemetry over a pointing angle (squint) from 0° to 95°. This is despite interference from microwave ovens, from 802.11b wireless LAN devices, beacon “swishers”, spin-fading and pigeons sitting on the feed. Above squint 95° signals are very weak, and spin amplitude-modulation coupled with FM effects from the magnetorquer become intense, but most blocks will still decode up to squint 110°. Figure 2 shows the effect of squint angle on symbol errors caused by fading.

If smaller antennas are your interest, then signals from the patch antenna seen in figure 3 will provide error-free telemetry throughout most of the orbit, weakening when the pointing angle (squint) is around 40-55° which is the spacecraft antenna’s first null and signals have a tendency to vanish.

If you want an ultra-small antenna, then since you can hear the AO-40 beacon on a ground plane (figure 4), signals will often decode successfully. For this, the squint

angle needs to be under than 15°, and the range preferably 50,000 km or less. Join your thumb and forefinger, and try to imagine how much spacecraft energy passes through the hole, because that’s what’s being processed. This is a remarkable result whichever way you look at things and there is scope for a lot more experimentation with very small antennas.

AO-40 FEC System

Phil Karn KA9Q’s proposal for AO-40 FEC’d telemetry is fully documented at [3,8]. Each element of the system and its rationale is straightforwardly explained.

Essentially we wish to combat two factors that introduce errors; spin modulation/fading and weak signals. Of these, spin modulation is responsible for the greatest destruction of telemetry.

Then, given that residual errors will still occur, we want to detect, and if possible, correct them.

In this experimental phase, FEC is applied to the second 256 bytes of the A-block only.

This contains all the spacecraft analogue and digital housekeeping data. These 2048 bits are processed as will be described which expands them to 5200 bits, for which the proper term is ‘symbols’.

The encoding process is illustrated in figure 5. The source data is divided into two halves of 128 bytes each and enter two Reed Solomon (RS) encoders which add 32 parity bytes each. Since the original data is present in the RS blocks, and typically contains undesirable systematic features such as runs of 0s, they are eliminated using a randomiser.

The parity protected data now enters a convolutional encoder which emits 2 bits for every bit entering. After a final flush to the all-zero state, a 65 bit sync vector is introduced, plus 3 spare bits, and a total of 5200 bits is deposited into the interleaver array ready for transmission on-air.

Decoding FEC

Decoding the off-air stream reverses these operations. Refer to figure 6.

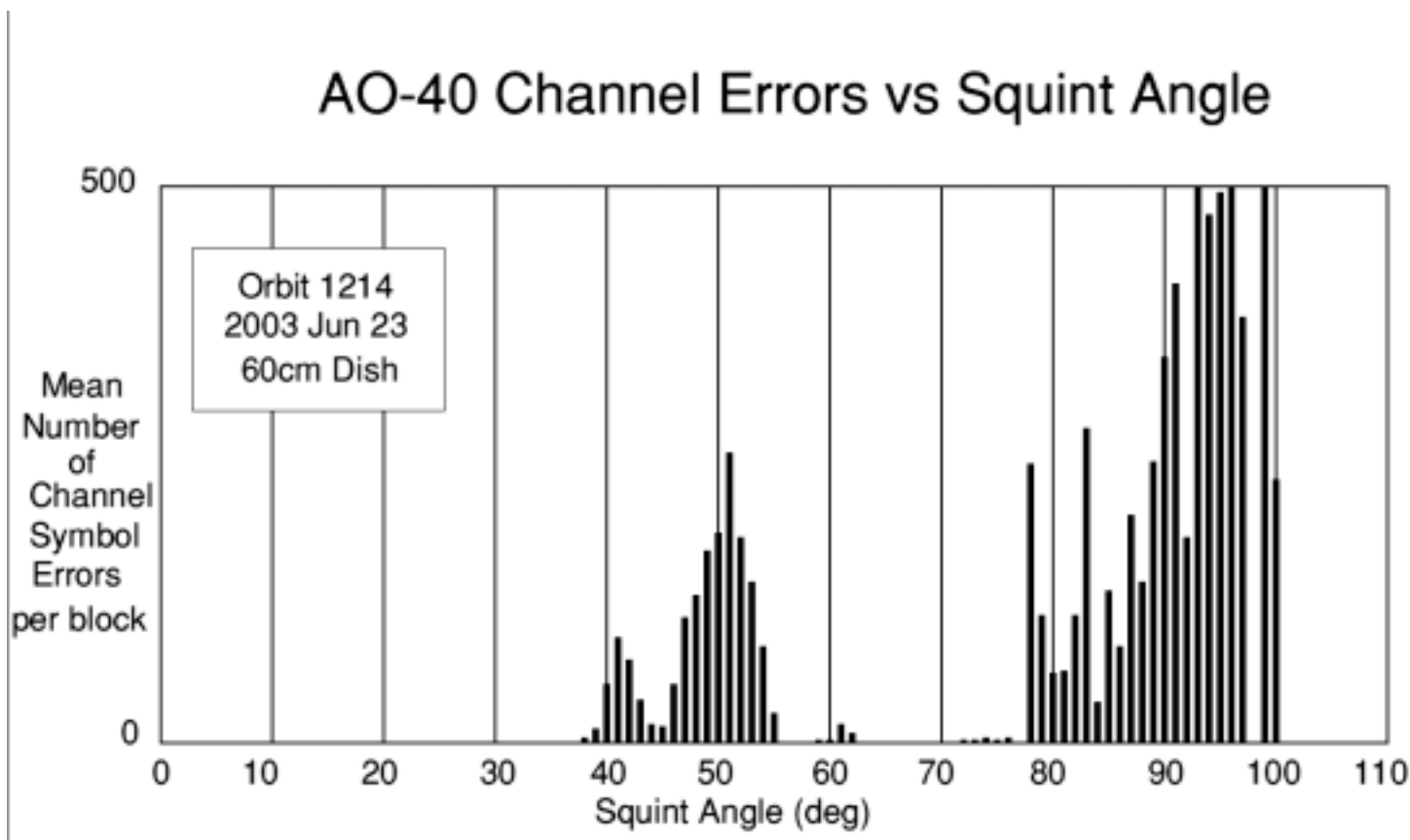


Figure 2. Channel symbol errors on a typical orbit averaged over each MA interval. The spacecraft antenna’s first null is apparent at squint angles 38-55°, the first sidelobe is from 55-80°. At 90° the spacecraft is sideways-on, and after that the antenna is masked; signals are very weak and choppy, but often decode. Key features in this profile translate into squint angle measurements and are even used for attitude calculations.

The stream of apparently random symbols is searched for the 65 bit sync vector. This is distributed throughout the 5200 symbol block, at every 80th bit position. When detected by a comparison (or correlation) process, the block is delineated and decoding the data can begin.

The primary defence against spin modulation/fading is a block interleaver, figure 7. The 5200 bits are arranged in an 80 columns x 65 row grid. Bit-stream data as received is deposited along the rows, row after row. But it is read out for processing by column. In this way a fade, which may span several rows, is smeared thinly by the read-out process, and its effects are easily dealt with by the error correction systems.

The next defence against channel errors, which are now (hopefully) evenly spread throughout the de-interleaved block is the convolutional code, figure 8. At the transmitter, each original bit entered a convolutional encoder, and gave rise to a pair of new symbols. The Viterbi convolutional decoder, named after its inventor, attempts to re-construct the original bit sequence given the fact that successive symbol pairs are related to their 12 predecessors. An elegant description of the Viterbi decoder is available at [4], and design information can be found in any book entitled "Digital Communications". It is an interesting and straightforward algorithm. The decoder can work at about a 10% input symbol error rate without making errors itself. Thereafter mistakes do happen, and small bursts of errors are emitted, which corrupt one or two bytes.

Final error detection and correction is done using Reed Solomon (RS) decoding. Whereas a standard telemetry block has a simple 2-byte checksum appended, adequate to detect errors but not correct anything, RS encoding appends many checking bytes. In the AO-40 system the additional 25% bytes (64) mean up to 32 bytes (actually 16+16) can be corrected per telemetry block. RS decoding is quite a complex process which exploits the number-theoretic properties of the encoding modulo-255 arithmetic. The classic description can be found at [2], but this is essentially a postgraduate text. I have not yet located a layman's guide.

If the block decodes without errors, as it usually does, then it is easy to re-encode the block and compare the expected symbols with those actually received. In this way a count of the number of channel symbol errors is obtained.



Figure 3. This RHCP patch has a gain of 8.5 dbic and a 3db beamwidth of nearly 90°. Its signals decode through most of an AO-40 pass, and with the wide beamwidth it only needs re-pointing every few hours.



Figure 4. Small is beautiful. The AO-40 beacon is often just audible on this. Using FEC, if you can hear it, you can decode it. So the FEC telemetry often decodes.

Overall, the Viterbi convolutional and RS block decoders working together can cope with up to 15% channel errors, or as many as 750 symbols (bits) per block. Decoding time depends on processor speed, and is of order 10/MHz seconds per block assuming a “C” program. For example, a 500 MHz processor would decode an FEC block in typically 20ms.

Implementation – Spacecraft

The AO-40 flight computer is not really fast enough to perform the FEC encoding, and though there is perhaps little appetite for serious 1802 assembly language programming, the possibility is being investigated. Happily, the AO-40 IHU-2 is some 2000x faster, and is dedicated to experimentation. It can take over the telemetry beacon but cannot harm the spacecraft in any way.

So for the initial trials the IHU-2 monitors the IHU-1 telemetry stream, captures any A-blocks therein, and performs the FEC encoding. The encoder is written entirely in IPS, and takes 100ms to execute. A reference encoder is at [5].

The IHU-2 beacon handler has been modified to send not only the standard telemetry A-block, but an additional 5200 bits, the FEC material. Thus the user receives the original data and its FEC equivalent every 27 seconds. This FEC mode is switched on frequently.

Implementation – User

Processing FEC data requires the receiving system to deliver data on a bit-by-bit basis, and of course the data format is different. Therefore changes are required to existing methodologies.

Getting from received audio to decoded data requires a signal processing chain which is implemented using various combinations of hardware and software. A reference FEC decoder is at [6].

There are many options for changes to hardware and software, and gradually they are being implemented. Here are some of them.

An important change is required of all PSK decoder implementations; it is that bit detection must no longer be based on a simple binary slicer. It helps the convolutional decoder to know whether bit detection was strong or weak. A slicer

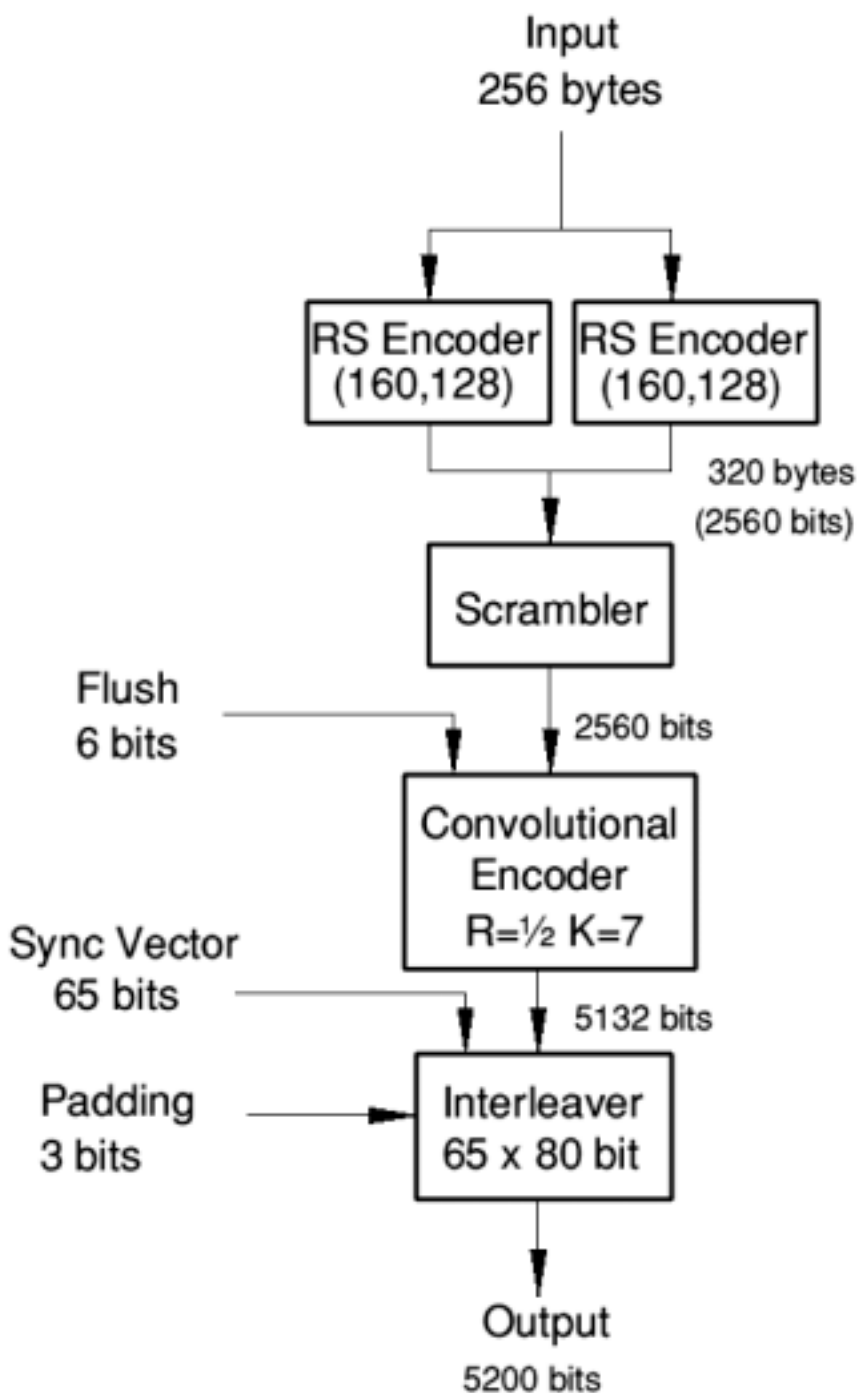


Figure 5. FEC encoding takes 256 bytes in and creates a block of 650 bytes (5200 bits) ready for the beacon to transmit. See text.

discards that information and implies all bits equally strongly detected; but in the presence of noise this is not true; some bits are more confidently detected than others, and this needs to be passed to the Viterbi decoder. The penalty for ignoring detection quality information is up to 2 db decoding loss, an undesirable waste of performance. Thus hardware PSK decoders, and soundcard/DSP-based PSK decoders must be modified to meet this requirement.

An analogue-to-digital converter kit is available for the G3RUH 400 bps PSK Data Demodulator hardware. This takes the output from the bit detector, digitises it to 8-bit resolution, and sends one byte per bit at 9600 bps down an RS232 serial port [7].

Soundcard DSP software is also being modified at the bit detectors; recent software has it anyway, e.g. Phil Karn KA9Q's for Linux [8].

FEC decoding can be done either by off-line processing which converts FEC blocks into conventional blocks, or it can be done in upgraded telemetry display programs.

The popular telemetry display program P3T for Windows by Stacey Mills W4SM has been upgraded to take serial data from a serial port ADC and decode the FEC format. Work is also in hand to add a soundcard PSK decoder module adapted from the design of Moe Wheatley AE4JY and others. P3T can also display telemetry logs created by other systems which may already have performed FEC decoding.

In a rapidly changing field this hardware/software guide cannot be complete. Refer to [9] for contemporary solutions.

Conclusion

These tests have overwhelmingly demonstrated the power of strong FEC applied to an amateur telemetry link. There would appear to be no obstacles to its adoption for future missions.

Acknowledgements

Many people have contributed to the FEC programme. In a necessarily incomplete list, we include Phil Karn KA9Q as FEC champion and architect; Jonathon Naylor G4KLX who wrote the FEC encoder in the IPS language for the spacecraft in 2 days, never having seen IPS before. Stacey Mills W4SM converted P3T to decode FEC, and evaluated several ADC kits in practice,

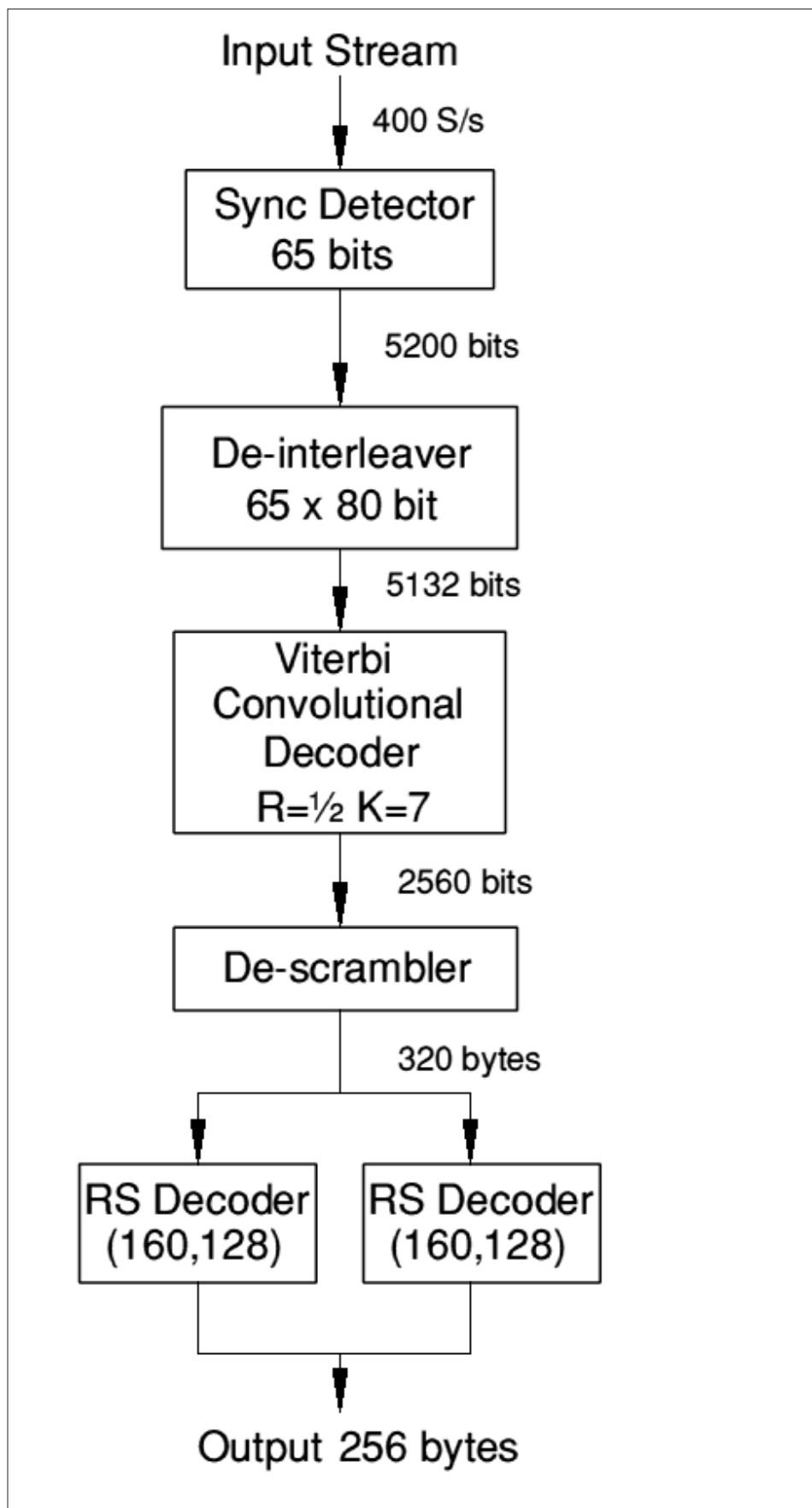


Figure 6. FEC decoding reverses the operations of the encoder. The de-interleaver compensates for fades, the Viterbi decoder corrects most symbol errors, and the RS decoders detect and correct residual errors.

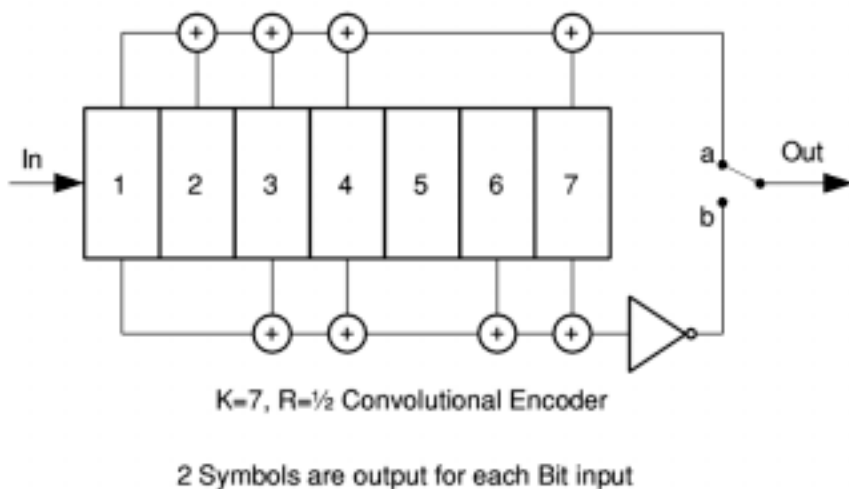


Figure 8. The simple structure of a convolutional encoder, which can be implemented in hardware with a shift register and some EXOR gates, or the equivalent in software. The constraint length K of 7 implies that a bit entering has an influence over 14 output symbols as it progresses down the shifter. The inverter prevents long runs of zero output.

whilst Andy Talbot G4JNT kindly developed the ADC itself. Paul Willmott VP9MU has managed all operational aspects of FEC telemetry collection, and also wrote some

soundcard DSP. Author James Miller G3RUH integrated the FEC into the spacecraft and managed all the disparate elements needed to see this project through

to usefulness. All contributed their time freely, and no animals were harmed.

References

1. "Proposal for a FEC-Coded AO-40 Telemetry", Karn P., Proc. 20th Amsat Space Symposium, 2002.
2. "Error Control Coding: Fundamentals and Applications", Lin and Costello, Prentice Hall, 1983, ISBN 0-13-283796-X
3. FEC Specification:
<http://www.ka9q.net/papers/ao40t1m.html>
4. Description of Viterbi:
<http://bipt106.bi.ehu.es/psk31theory.html>
5. Reference encoder:
http://www.ka9q.net/ao40/encode_ref.c
6. Reference decoder:
<http://www.jrmiller.demon.co.uk/p3d/decreef.zip>
7. ADC Kit:
<http://www.jrmiller.demon.co.uk/products/adc.html>
8. KA9Q's FEC page:
<http://www.ka9q.net/ao40/>
9. FEC solutions page:
<http://www.amsat.org/amsat/sats/ao40/ao40-t1m.html>

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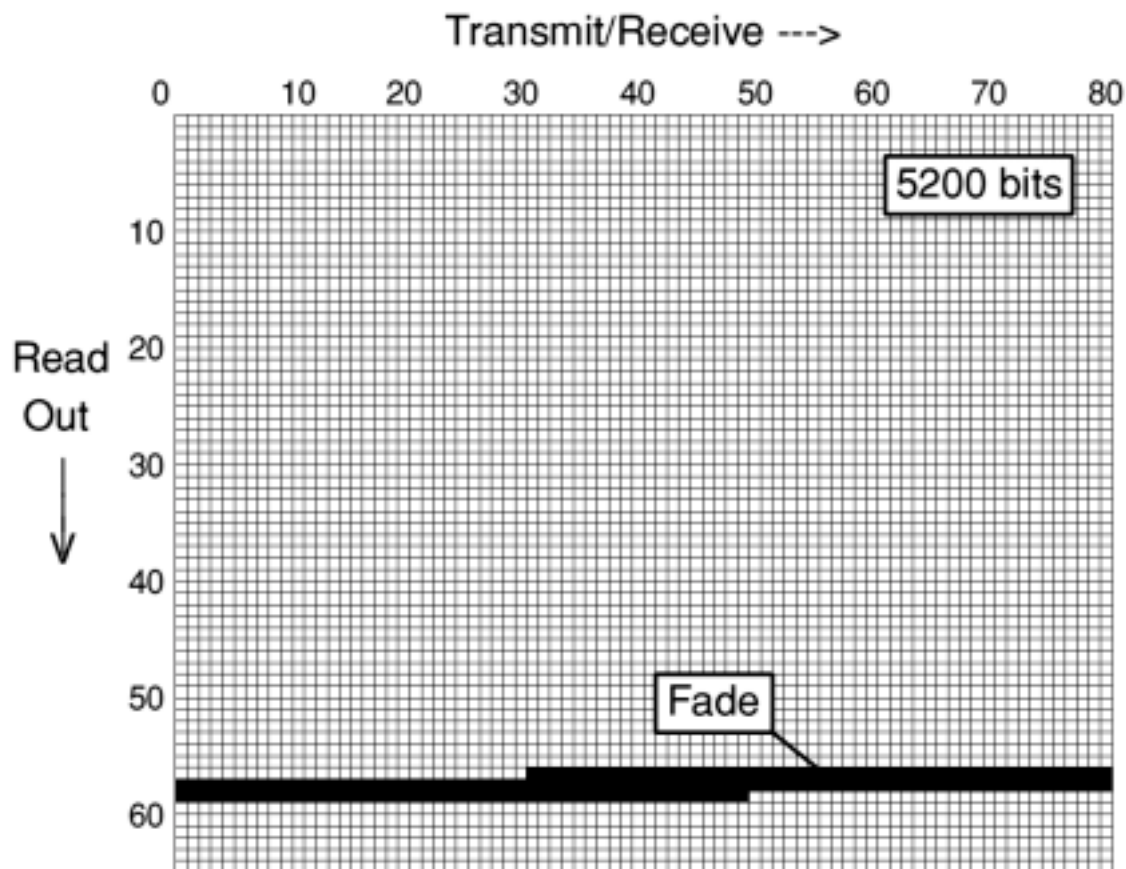


Figure 7. The interleaver holds 5200 bits. They are transmitted (and received) along the rows but are read out down the columns. Thus long fades, such as the one illustrated, only affect a few bits at a time in the read sequence, and are easily corrected by the Viterbi decoder.

Satellite DX by Wayne Estes, W9AE

What an amazing summer this has been for satellite DXers. The level of DX activity is steadily growing and is probably now equal to the "glory days" of AO13.

It took real dedication to work the rare DX stations this summer because of the timing of AO40 passes. Most of the good DX windows occurred between 1 and 5 AM for North America.

Heard on the Air

YL2LW (Latvia)
SV5BYR (Rhodes, Dodecanese Is.)
9Y4AT (Trinidad & Tobago)
EX8MLT (Kyrgyzstan)
HL2JFN (South Korea)
VU2MKP (India)
5N0EVR (Nigeria)
8J1RF (Antarctica)
FR5AT (Reunion)
EI4HT (Ireland)
A22BP (Botswana)

Nori A22BP normally operates from an east-facing apartment balcony. During July 19-22 he operated portable in order to work the Americas on AO40.

Ed 4L4FN (of North Korea fame) has moved to Angola and plans to set up an AO40 station. Keep your ears tuned for this exciting development.

Recent DXpeditions

7P8NK (Lesotho) July 19-24.
Neil VA7DX made 187 AO40 contacts from Mohale's Hoek in the Kingdom of Lesotho. He had never made a single satellite contact before this. It was truly an amazing effort, and satellite DXers worldwide are grateful. More than half the contacts were on CW because of his weak uplink.

3DA0 (Swaziland) Jul 31-Aug 2.
Neil VA7DX made 104 contacts in only 3 days, despite significant obstructions from nearby hills. Another great job! Hopefully the success of the 7P and 3DA team will motivate other HF DXpeditions to try AO40.

V31WD (Belize) July 15-21
Wayne Day N5WD was active on UO14 from Belize (grid EK56). He made a total of 62 contacts. That's pretty good considering how difficult it is for a handheld station to be heard in the chaos of a typical UO14 pass.

CT3/CT1EAT (Madeira). July 23-30
Francisco Costa operated AO40 from Porto Santo, Madeira July 23-30. This was a solo vacation-style operation. He made a total of 178 AO40 contacts with 31 DXCC entities. He had hoped to make more contacts, but many of the windows occurred while most people were working or sleeping. Costa is hoping to operate from a rare African country next year.

TZ6RD (Mali) August 12-23
Doug Faunt N6TQS activated yet another rare entity as part of a major DXpedition team. This operation attracted some unruly pileups, but Doug managed to make 120 contacts.

JD1YAB (Ogasawara) August 2003
There was sporadic AO40 activity, but few if any North Americans managed to work this group.

V31KD (Belize) Aug. 30-31
Jim Huhta AA4MD was active on AO40 from Belize. This is not rare for North America, but it is rare for the rest of the world.

KH2GR (Guam) Sept. 5-8
By veteran Japanese satellite DXer Yoshi JF6BCC.

C3/EB4AFK (Andorra) Sept. 6-7.
Another example of how portable AO40 equipment makes it easy to activate a rare entity.

Future DXpeditions

3A/F6BEG (Monaco) Sept. 19-21
Gerard F6BEG plans a weekend AO40 in Monaco, but he does not yet have hotel arrangements that will give him good visibility to AO40.

EA6/DK2ZF (Balearic Is.) Oct. 3-17.
Rolf Niefind DK2ZF plans to use his new portable L/S station from the Island of Mallorca. This is a "practice" trip to ensure that the new setup will work during his planned multi-island Pacific vacation in March/April 2004.

VK9X (Christmas Island). October 4-11.
This DXpedition by 4 German hams will include AO40 satellite operation. Hams in the eastern U.S. won't have a window, but hams in the central and western U.S. will have short windows.

Continued on Page 31



Wayne Day N5WD operating a UO14 pass in Belize. Photo by KB5UAE.



Neil King VA7DX operating AO40 in Swaziland, using an IC-706 for uplink and FT-897 for downlink.



The Lesotho satellite team had to climb on the roof to adjust antennas. They moved the antennas to the roof in order to work AO40 at much lower elevation.

Field Day 2003 Results

By Bruce Paige, KK5DO
Vice President of User Services

This year a total of 37 logs were submitted, down from the 38 logs in 2002. 29 in the Emergency Power class and 7 in the Commercial Power class. Submissions came from all over the United States, Canada and Mexico.

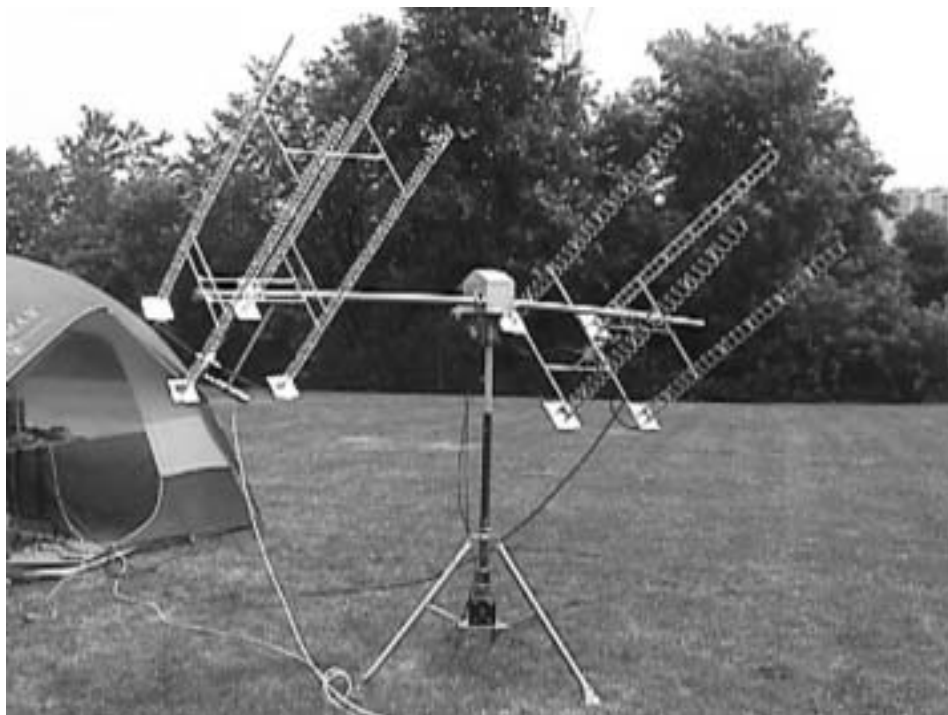
The first table, below, provides a breakdown of the 2117 total reported QSO's which were up from the 1905 QSO's reported last year.

Satellites Worked FD2003			
Satellite	CW	SSB	FM
FO-29	1	98	-
AO-40	341	1591	-
AO-7	-	14	-
AO-27	-	-	11
UO-14	-	-	12
SO-50	-	-	7
ISS	-	-	42

This year, like most other years, the top contenders were in a bitter battle for first place. Upsetting K4BFT, who fell to 4th place this year were N4TP, K5DX and W9QL. Sitting on top of the pile for Emergency Power class is N4TP, the Tampa Amateur Radio Club with 287 points. Operating this winning station were Jim, AA4MD and Warren, W1GUD. Following behind them in second place is K5DX, the Texas DX Society with 253 points. Glenn, WB5TUF submitted their score sheet. W9QL was the call used by Wayne, W9AE and the Lake County RACES group with 215 points taking third place. For Emergency Power at Home class, Ron, W6ZQ takes first place.

The table on the right provides the scores and overall standing of everyone who submitted their Field Day logs.

I would like to thank everyone that participated this year and submitted a log. As in previous years and am sure years to come, everyone had fun. From the mosquitoes in Houston, to the rain in Atlanta you swear you'll never do this again. Well, at least not until next year.



This picture from the Ottawa Amateur Radio Club, VE3RC field day site shows quad helices for their AO-40 setup.

Rank	Group	Class	Score
Emergency Power Entries			
1	N4TP	2A	287
2	K5DX	1A	253
3	W9QL	1A	215
4	K4BFT	1A	182
5	W9LDX	2A	182
6	K5OE	1B	155
7	VE3RC	2A	128
8	W2LV	3A	101
9	W5W	2A	89
10	W6PIY	2A	88
11	W1PA	2A	88
12	N2RE	5A	73
13	W9RCA	1A	69
14	W6NWX	5F	66
15	W4NLX	5A	63
16	K6HAI	3A	60
17	W4BOC	4A	59
18	K7AM	1A	55
19	W0MI	2A	54
20	N4XU	3A	54
21	KC0AHN	5A	45
22	WA3NAN	2A	43
23	NA1SS	1B	40
24	K3PZN	11A	27
25	WA6IRC	4A	8
26	W4JBB	1A	4
27	N1EV	3A	4
28	W2RS	1B	2
29	N5AFV	4A	2
30	K6AA	7A	1
Commercial Power Entries			
1	W6ZQ	1D	90
2	XE1MEX	1DX	53
3	KB6A	1D	49
4	VE2DWE	1D	40
5	XE1GRR	1DX	40
6	N1JEZ	1D	32
7	KK5DO	1D	1



Here are some of the guys from W5W, the Hill Country Amateur Radio Club. It looks almost as if they are having fun, roughing it in that building.



Helping set up the antennas and doing the final adjustment of the AO-40 down converter for the K6HAI, North Shores Amateur Radio Club is Bill. In fact, this was the 21st field day that he has attended and he is only 20 years old. The grandson of Dave, WB6LLO, learned code and just hasn't got around to getting his license yet. Maybe it is because he's using the hammer to send code against deed restrictions.



If you happen to pass this vehicle on the road, you better watch out. Those kabob skewers (right) look pretty mean. I am still trying to figure out how Cowles, K4EME, manages to point them at the satellite while he is driving. The bird bath in the foreground even looks as if you could use it for some AO-40 QSO's.



(above) This picture was taken by Don, N5DD and is the small portable setup of the Texas DX Society, operating K5DX. Notice the small dwarfed satellite antennas in the center of the picture. It looks to me like they could create their own storm on that beach.

(left) This is the way to go, a pick up truck (right) with a camper shell and all the antennas you would want for field day for the satellites. This was the NX2Q team and Joe, N2QOJ and his buddy would just love to have you stop by the High Point State Park in New Jersey and visit with them next year.

KC0AHN
Boeing Wichita, KS.
BEARS Club

The “Boeing Employees Amateur Radio Society” (BEARS) satellite station was operated under the club call, KC0AHN. The operators were Bill Briles, W0OQC, Joe Johnson, N0KTA, and Greg Wycoff, N0ZHE. The Field Day site was located in flat Kansas wheat country 40 miles north of Wichita, KS, (Grid Square EM18) at the QTH of Bob Bailey, KA0MR.

The satellite station’s equipment was; a 70 centimeter 17 turn helix, a 2 meter 7 element Yagi, a 2.4ghz 4ft. diameter dish with screen mesh and a 4 turn helix feed to a Conifer pre-amp and Drake converter. The transceiver was a Yaesu FT-847. Antenna tracking was done with a laptop computer running NOVA and a FodTrack interface which ran modified Alliance rotors.

Saturday at 1800Z the equipment worked flawlessly. AO40 signals were strong and 40 contacts were made in 3.5 hours. Four contacts were made on FO-29 and one contact was made on UO-14.

AO-40 was to come up at 4:00 AM Sunday local time with a low squint angle and clear view to the southeast. We were dreaming of 20 to 30 contacts per hour for a 5 hour period. The club field coordinator came around at 2:30 AM informing us of an approaching storm. We decided to put the electronics in a dry place. The station shelter was a top cover with screen slides; not made to keep out rain. The rain started about 3:30 AM local time and was still raining at 10:00 AM when we decided to call it quits. We packed up in the rain and left; saying we would have done great if it hadn’t rained.

Despite the disappointments, the weekend was still worth it; we all enjoyed the discussions while it was raining, some strong coffee, and watching Joe, N0KTA, making contacts on AO-40 for the first time.

(top) Joe N0KTA operating AO-40 make’s his first ever AO-40 contact.

(middle) The KC0AHN satellite antennas.

(bottom) Little house on the prairie ... KC0AHN satellite ops tent.



W8QLY Mahoning Valley Amateur Radio Association

The W8QLY (Mahoning Valley Amateur Radio Association) worked 8A, OH from WA8GLF / Jack Chapman's farm. Thanks to Jack for allowing us to use this beautiful site. We attempted to work UO-14 with an HT, and Arrow Antenna on Saturday. We couldn't get into the bird to make even 1 contact. I had hoped things would have been better this year, but I think it actually was much worse.

After letting my club down 2 years in a row, I was bound and determined to make a satellite contact, yep just one is all they wanted. I stayed up all night putting together the portable AO-40 station pictured. It wasn't the best, but it's all I had to work with. I used a 21 Element Loop Yagi made for 2.3 Ghz. terrestrial work, and my SSB Down Converter. On the uplink I used a 14 Element cross yagi, that was buried in the garage for a couple years. I finally got everything together around 3:00 a.m and was ready to listen for the beacon in about an hour. We heard the beacon shortly after the bird came over the horizon, and we really got excited. I didn't know how well the little loopier would work, and was very surprised at how well it did work.

After tuning around and hearing a couple Italian stations, MUCH LOUDER than the beacon, I decided to try to find my downlink. I was using 25 Watts, and thought that would be enough, Not a chance, so I went home for a 100 Watt Amp. After implementing the amp, I was able to find my weak CW signal using 65 Watts. The excitement level jumped 20 db, when this happened! As I spun the dial, WA8GLF / Jack and KA8R / Andy, two of our local CW Speed Demons eyes lit up. Most of our club members had never heard AO-40, and they were expecting another UO-14 type satellite. First they heard Italy, then France, and then U.S. calls! Their interest was really peaking and they couldn't believe what they were hearing out of this 2 Meter Radio (FT-736R). Now we were going to try to work someone, and K5DX was the first one we found in CW. He called CQ, and I answered. WOW... he heard W8QLY on the first call! We exchanged info and a loud cheer came roaring from the crowd as RRR & 73 was sent! It was a great feeling to finally work someone on the birds! We scanned around and heard W4IY calling CQ in SSB, I answered his CQ in CW, and he came back first call, again! After a long day and night,

I was exhausted and decided to tear down before the storm moved in. I got things packed around 12:30 just in time before the wind picked up and the dark clouds moved

in. Thanks to K5DX & W4IY for the satellite contacts and for a great field day, you made many guys & gals in Youngstown, Ohio very happy!!



The W8QLY Field Day Site



(above and right) AMSAT-NA President Robin Haighton, VE3FRH operating AO-40.



Dino, VE7XDT at the satellite position at VE7SUN

VE3RC Ottawa Amateur Radio Club

The Ottawa Amateur Radio Club VE3RC satellite station was assembled by Clare Fowler, VE3NPC. Gord Grant, VE3DY ably assisted in set up and operating. We operated only on AO40 using mode L/S. A Yaesu FT-736R transceiver with the 1.2 GHz module provided 10 watts output for the mode L uplink. A transystems 3731 down converter into the Yaesu FT-736R on 2 meters provided the 2.4 GHz downlink. Lightweight high gain helical antenna arrays were used on both L and S bands. Four 27 turn helical antennas made up the L band array, while four 53 turn helical antennas were used on S band. Both the up and down links worked superbly. We made 102 QSO's in spite of a set up gremlin that severely reduced our operating on the one and a half hour Saturday window.

To clear the site's trees we located the satellite station on higher ground. This meant we were some distance from the AC generator. We opted to use batteries for power. Everything seemed to be operating satisfactorily until we tried on the air testing. The audio coming back from AO40 was highly distorted. We tried different microphones and toroids for RF filtering. All to no avail. CW seemed to work OK. After the pass we finally determined our FT-736R did not work properly with 12.5 volts DC power input. A small AC generator was brought in by Gord and everything worked normally for the Sunday pass. Mother nature cooperated with two very nice days for an excellent FD.



*Photos on the right (top) Jerry, K5OE and Ron, AG5RS Field Day set up.
(middle) Ron, AG5RS, shown operating the Aggie-Trac for precise antenna pointing.
(bottom) The operating position at K5OE/5*

*Photos on the left (top) Angel, WP3GW, operates at the EOC at Academia de Centro de Manejos de Emergencia in Gurabo, Puerto Rico
(middle) Bill Acito, W1PA sets up his satellite antennas for Field Day.
(bottom) Close up of the W1PA antennas.*



NS1RA North Shore Radio Association

Tony Monteiro, AA2TX, setup a basic mode U/S AO-40 satellite station as part of the North Shore Radio Association field day activities, NS1RA. None of the other club members had worked AO-40 before.

For receiving, we used a cardboard-box and aluminum foil horn with an AIDC down converter. My 8 year old daughter painted the box red, white, and blue and added the club's logo. It attracted a lot of attention, and it worked very well.

My cardboard box corner-reflector that I planned on using wouldn't fit in the car so we field-day-tested a new experimental antenna I've been working on. It is a little panel reflector, only 2 foot x 2 foot and less than 6 inches high for 435 MHz. It provides a RHCP and around 10 dB gain.

The antennas were pointed using a compass and a protractor.

We used a "barefoot" FT-847 controlled by an old 166MHz laptop running InstantTrack

and InstantTune (to eliminate "ditting.") In spite of running relatively low-power (for Field Day,) we had no problem hearing our own downlink even as the squint got to be 20 degrees near the end on Sunday.

After I made a few contacts to verify the station was working, I handed over the station to anyone who wanted to try working the satellite. We probably only made a couple dozen contacts (like one per operator) but lots of club members got a chance to try AO-40 for the first time. The response was overwhelmingly positive with the station getting lots of attention and interest. Several of the new operators expressed amazement at how much clearer and easier the satellite was to hear versus the HF stations they were also operating that weekend. Several ops expressed interest in setting up their own AO-40 stations. With a little luck, we will have a few more AMSAT members.

Thank you to everyone who worked us and for being patient with our inexperienced ops.



(left) NE6Q operates AO-40 with a straight key at the Palomar Amateur Radio Club's W6NWG Field Day site.
 (right) A shot of the W6NWG helix uplink antenna for AO-40. The little generator is doubling as a paperweight to keep the antenna from blowing over.

Photos on lower-left, (top) Lincoln County Amateur Radio Club, Oregon, K7AM satellite operating position.
 (middle) Indian River Amateur Radio Club, W4LNX Satellite FD station. Shown are George, KF4XB (left) and Lee, KU4OS (right)
 (bottom) The satellite antenna at W4LNX.



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Photos below, N7UW Wyoming Field Day. The AA2TX aluminum foil horn for AO-40 downlink is shown in the middle photo. The UHF Quagi was the uplink antenna.



SSB Electronics Ad



Steve W4EPI and Les W4SCO hard at work on AO-40 at the W4BOC Field Day site.



Steve (a Yaesu man) learns how to use the IC-910



Hmmm, this button worked last time, "QRZ?"



W4BOC satellite antenna array.

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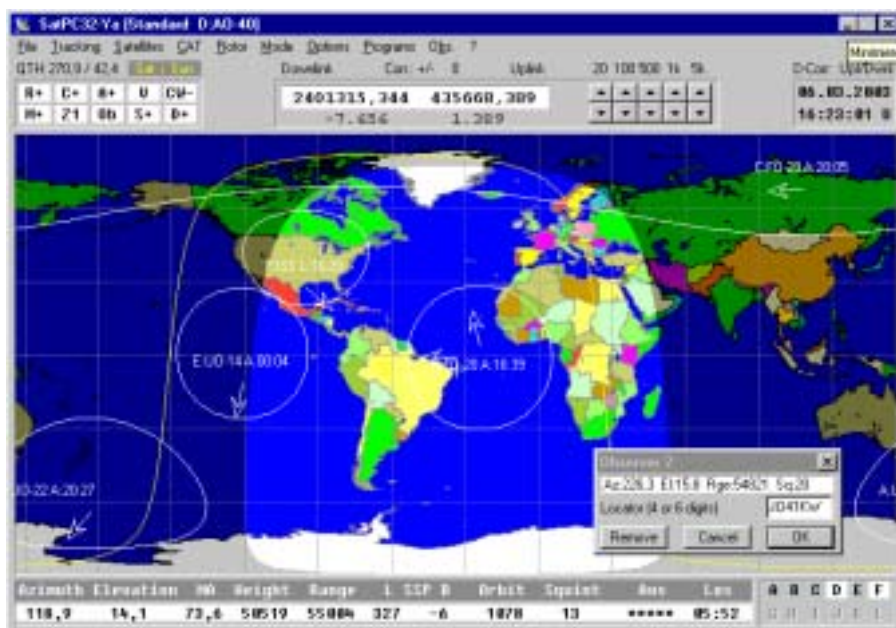
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Order by calling 1-888-322-6728, or use the online shop at www.amsat.org.
The author DK1TB donated SatPC32 to AMSAT. All proceeds support AMSAT.



Field Day High Power Uplinks Hammer AO-40 Again

By Lee McLamb, KU4OS
ku4os@amsat.org

The joint AMSAT/ARRL Field Day was held over a 24 hour period starting 1800 UTC, 28 June 2003. The charts below are an analysis of the telemetry data collected over the Field Day weekend as well as observations made while operating our Club QRP satellite station. This analysis will be broken down to look at two primary periods. First the period prior to the official start of Field Day when stations were setting up and finally the actual Field Day period itself.

Chart 1 and Chart 2 cover the period on 28 June 2003 from transponder turn on at Mean Anomaly (MA) 30 to the start of Field Day at 1800 UTC. Chart 1 shows a timeline of the actual AGC values while Chart 2 shows the distribution of U-Rx AGC measurements. As you can see the U-Rx AGC level was fairly constant with the most common value being 7 dB followed by 13 dB. This is somewhat worse than the pattern seen over a "normal" five orbit period in December 2002 (see <http://home.cfl.rr.com/lmclamb/ao40agc1202.html>) However, this still represents stations running over 4 to 20 times the required power needed for a signal at the proper level of 10 dB below the Middle Beacon (MB). During this period our club station was still able to complete SSB voice QSOs with other stations using our 5w transmitter operating into a 14 turn helix. This combination represents an EIRP of only 125w. This was also consistent with performance on prior weekends with similar activity levels in that we had no trouble making random QSOs, ragchewing or checking into the AMSAT Beacon+20 net with 125w EIRP.

I would like to note that even though we were still able to make contacts, it was quite clear that our low power uplink was being adversely affected by the higher power stations pushing the AGC around between the 7 and 13 dB level. Just because it has become common for stations to run excessive power, it does not make it good operating practice.

Unfortunately, Field Day has become the showcase of poor satellite operations. Instead of demonstrating to those unfamiliar with OSCAR operations how easy it can be, we have allowed the unrelenting quest for uplink power to make our satellites difficult if not almost impossible to use.

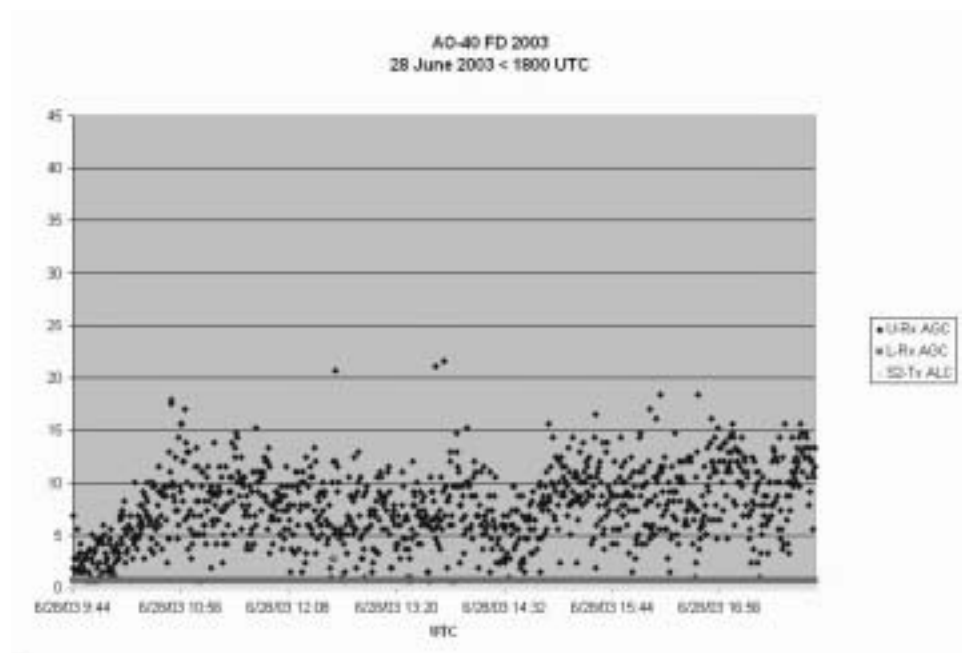


Chart 1

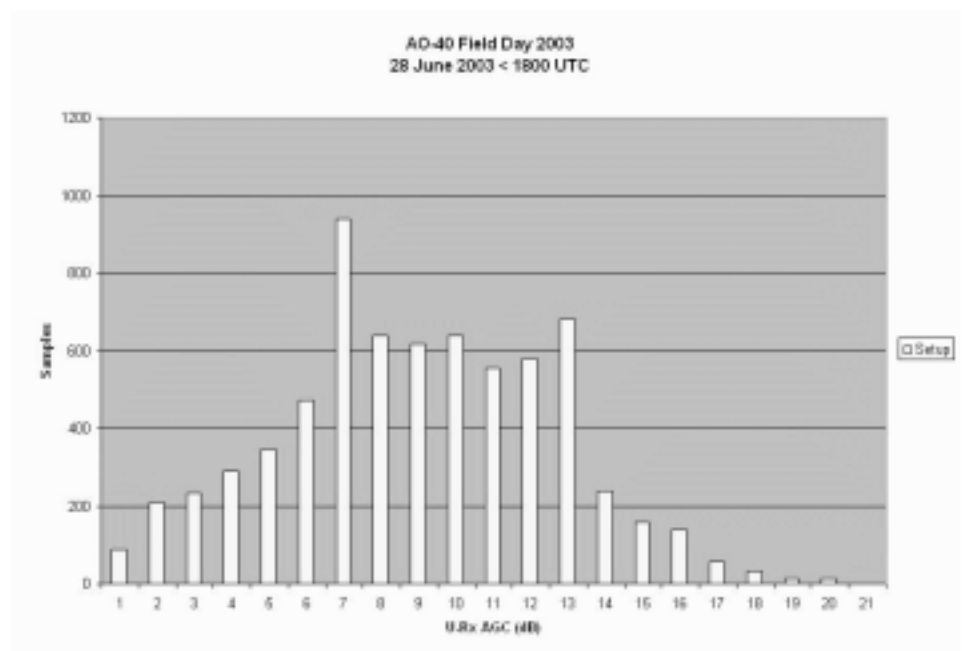


Chart 2

Why did everyone crank up the power 10 dB at 1800 UTC?

Chart 3 shows the AGC data for the 24 hour period starting at 1800 UTC on Saturday. I've also included some bars near the top to indicate which portions of the world were in the footprint at various times. There are

interesting things to note about both the U-Rx AGC and L1-Rx AGC so I will address each in turn.

Starting with the U-Rx AGC, by comparing Charts 3 and 4 with Charts 1 and 2, we can see very clearly that it jumped up by 10 dB to the 15-17 dB range when Field Day started

and remained in that area for almost the whole weekend. In addition the U-Rx AGC distribution shown in Chart 4 only includes samples from the portion of the Field Day weekend when some part of the North American Continent was within AO-40's footprint. The result is not too different than the experience during Field Day 2002 (see <http://home.cfl.rr.com/lmclamb/ao40fd02hist.jpg>). This is very interesting since presumably many of these same stations were successfully running 1/10th the power earlier in the day and therefore knew that more power wasn't really necessary. Some of this may have been the result of unknowing new operators simply following the recommendations in the June 2003 QST Amateur Satellites column, which said that "You'll need about 100w to an 11-element Yagi on 435 MHz for the uplink" instead of reminding operators of proper procedures.

The net effect of this over powered uplink condition is that stations which should have been able to work everyone both on voice and CW were limited to only CW. As a result, contacts that could have been made were lost. Or to put it another way, by increasing their power, stations actually caused their Field Day scores to be lower. We found that our QRP Club station was always able to be copied in CW even at squint angles up to 20 degrees and down to 1.5 degrees elevation. In fact, a few times we even reduced the power output of the TS-790 to the lowest setting and still had no trouble hearing our own downlink.

The L1-Rx AGC as has been noted before has its activation threshold set considerably higher than the U-Rx AGC. Signals have to be noticeably stronger than the MB to start activating the L1-Rx AGC. During the entire pass on Saturday, the L1-RX AGC never moved except for one sample during the set up period.

On Sunday it was quite a different story. Shortly after the transponder switched on over Central Europe the L1-Rx AGC started showing a noticeable amount of activity. This particular activity can not be laid at the feet of the Field Day operators since they were not yet within view of AO-40. The L1-Rx AGC level increases even more as the Americas come into view and continues until Central Europe falls out of the footprint as AO-40 drifts West. Also during this time we find occasions of S2-Tx ALC activity.

As was noted during the January 2003 QSO Party (see <http://home.cfl.rr.com/lmclamb/ao40qsoparty0103.html> and the March/April

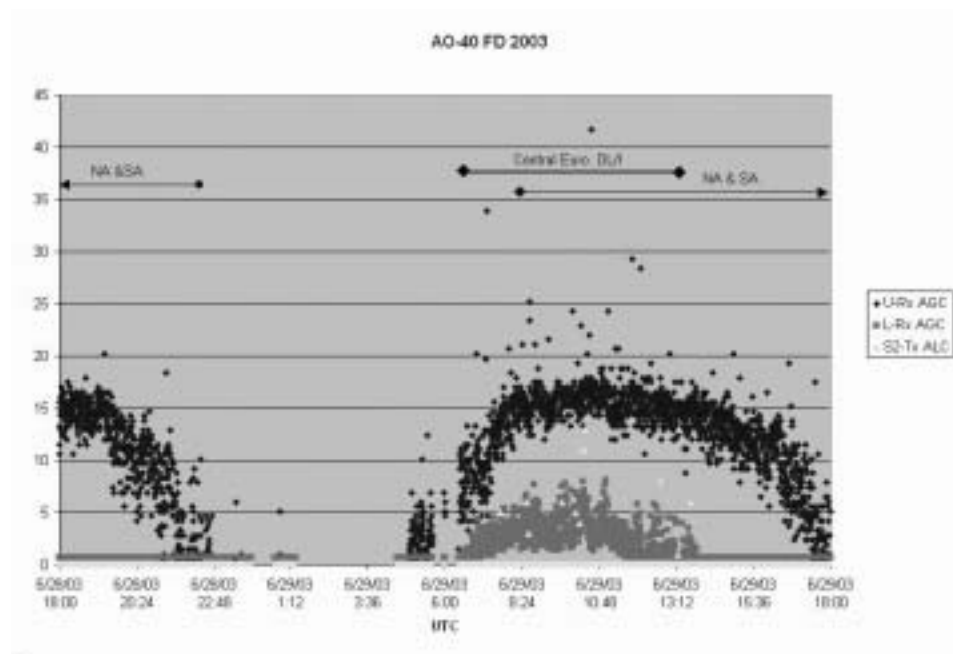


Chart 3

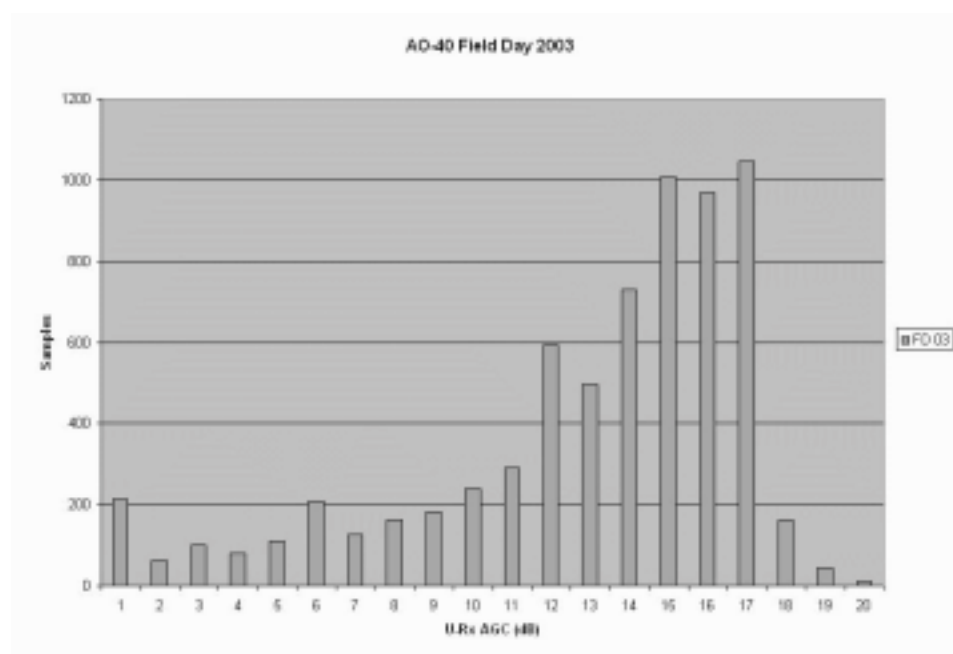


Chart 4

2003 *AMSAT Journal*) it appears to take a combination of many strong signals on both the U-band and L-band uplinks to cause the S2-Tx ALC to become active. Even before the Tx ALC becomes active and in addition to the problems caused by Rx AGC activity, there are other detrimental effects to running excessive uplink power. Most noticeable is the increasing levels of intermodulation distortion (IMD) showing up in the transponder passband. These IMD products can be heard as spurs of the MB which match the keying of high power CW stations. It also shows up as inverted

sideband voice usually on the opposite side of the MB from the offending station. All of this has the effect of making it unnecessarily harder to work AO-40 either through reduced gain and increased interference.

Conclusions, Opinions and Suggestions

We simply are not doing a good enough job of challenging operators to follow the recommended operating guidelines. Along these lines we need to make sure that a consistent message is being presented. Part of the consistent drum beat needs to be that

stations should routinely compare their signals to the MB. The proper uplink power is the minimum that results in a signal no stronger than 10 dB **below** the level of the Beacon. This message needs to be repeated frequently both in print and on the transponder.

There are several other steps I think we can take to improve the situation both during these special operating events and in general.

- Make sure that all event promotions include and emphasizes the MB-10 dB operating level.
- Include EIRP based power categories in the scoring. You get more of the behavior that is rewarded. Those stations operating correctly need to be recognized and rewarded.
- Don't always answer the strongest station that calls, especially if the station is clearly operating with excessive power.

AO-40 has great potential to be even easier to use than it is today. It could be a great asset during an emergency for providing regional or national coverage of the affected area. For the last two years, we have not taken full advantage of the opportunity at Field Day to demonstrate just how useful and accessible AO-40 can be. Field Day is perhaps the single best chance during the year to expose the non-satellite community to our niche in the hobby. AO-40 will become more and more impressive each year as we continue through the lean years of the sun spot cycle and the HF operators find the lower bands in worse and worse shape.

Next year, let's do our best to put on a really good show.

If you have any questions or comments please feel free to respond either via the AMSAT-BB email list or directly to my email address. ■

AMSAT President's Letter - August 2003

At the end of July I visited the AMSAT-UK 18th Colloquium, held at the University of Surrey in the City of Guilford near London. I am pleased to report that as usual the Colloquium was a great success and provided the opportunity for me to talk with the presidents and leaders of other AMSATs. In general, most AMSATs have

much the same concerns as we do in North America, and revolve around frequency loss and intrusion into the amateur frequencies of services that probably should be elsewhere. AMSAT - UK provided many good papers for thought, and two in particular that I would like to bring to your attention. These are a paper by Jerry Brown K5OE on his working portable with AO-40, and a paper given by James Miller G3RUH on working FEC telemetry with AO-40. Jerry is becoming a fixture at AMSAT-UK, his papers are amusing, practical and technical in nature. I have asked Jerry to repeat his paper in Toronto - If for any reason he cannot do so then we will find a person to read it for him.

James' paper on the use of Forward Error Correction (FEC) with AO-40 telemetry was another paper that I had great pleasure in listening to as James went out of his way to thank Phil Karn K9AQ for his persistence in "pushing" FEC as the right system to ensure better copy of the AO-40 telemetry under very adverse conditions. To quote James "It is one of the best things, for Amateur satellites, to be developed in the past 20 years. My congratulations to Phil, James and the whole implementation team that helped bring this about and another thank you to AMSAT VP of Operations Stacey Mills W4SM for modifying his telemetry program, so that we all may use the FEC operation.

Tom Clark W3IWI, has put out an e-mail with his observations concerning ECHO, Tom explains the status of the satellite and advises that it is anticipated that it will be launched on March 31, 2004, some 6 weeks earlier than I had expected. So if you wish to fly your callsign on the satellite you had better get in touch with Martha asap (301-589-6062) and advise her of the details as well as paying the modest fee. Also see page 23 of this issue of the *Journal*.

I am pleased to advise that Barry Delong (VA3BJD) and his crew are in the final stages of developing the AMSAT-NA Annual Meeting and Space Symposium (the 21st). Details of the hotel and registration can be found both on the AMSAT Web site and in this *AMSAT Journal* (see pages 6 and 7). Toronto is now effectively SARS free as was demonstrated on July 30 when over 400,000 people attended an outdoor concert in Toronto with many attendees from the USA. We are all looking forward to seeing you in Toronto on October 17, 18, and 19. In addition to the normal papers etc. that are expected at AMSAT meetings there is a great program for spouses. On the Sunday

morning there is a visit to the Hammond Radio Museum, one of the top rated museums of its type in the world. Please refer to the *Journal* and the Web site for details - Book early to get the best prices.

73

Robin Haighton VE3FRH
President ■

Results of the 2003 AMSAT Board of Directors Election

As a result of the election, W2GPS, VE3FRH, WD4ASW and W8GSM will serve on the Board for two years. W5DID is the First Alternate and W4EPI is the Second Alternate. The Alternates will serve until the next election. The results of the voting are:

Rick Hambly, W2GPS.....
Robin Haighton, VE3FRH.....
Barry Baines, WD4ASW.....
Gunther Meisse, W8GSM.....
Lou McFadin, W5DID.....
Steve Diggs, W4EPI.....
Lee McLamb, KU4OS.....
Ken Chaffee, WA1QXR.....

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The AMSAT-UK Colloquium: Report From Across the Pond

Gerald R. Brown, K5OE
k5oe@amsat.org

The AMSAT-UK Annual Colloquium is held every summer at the University of Surrey (UoS) in Guildford, England—not far outside London. UoS is also home for Surrey Space Technology Ltd. (SSTL), builders of the UO-Sat line of spacecraft, including UO-22 and the very popular UO-14.

The 18th annual colloquium started Friday with a tour of the SSTL facility, including visits to the satellite command center, component assembly rooms, and integration rooms. Chris Jackson, G7UPN, was our host. He explained the roles of various spacecraft currently in orbit and their communication schemes. Chris demonstrated some 32 m resolution pictures downloaded from AlSat-1, and discussed the plans for future spacecraft communications technologies. It was interesting to note SSTL's plans to move from predominantly S-band to X-band downlinks—with up to 40 mb/sec data rates. I also noted the long-standard TS-790 radios were still in use but new installations utilized the IC-910H.

Following lunch, the welcome address from Prof. Sir Martin Sweeting, G3YJO, included interesting anecdotes of the earlier days of SSTL and the growth and success from its Amateur Radio roots. There were subsequent presentations from UoS staff on emerging technologies, but the presentation from Charlie Suckling, G3WDG, on “Experiences with AO-40 on K-Band” was of great personal interest. Charlie had some excellent pictures of his 24 GHz hardware setup and presented details of the mysterious 6 dB loss “event.”

While the presentations were continuing in the main lecture hall, Howard Long, G6LVB, and Dave Johnson, G4DPZ, provided a hands-on beginners session. At the RSGB's GB4FUN mobile radio shack, Howard gave an impressive demonstration of adjusting frequency to compensate for Doppler shift, ending “smack on” FO-29's downlink using the TS-2000 and Kenwood's PC-based software. The GB4FUN vehicle is quite impressive, sporting various HF and V/UHF antennas, but also having a full satellite station with V/UHF cross-Yagi's and a G3RUH dish and patch feed.

Friday evening brings the much-anticipated BBQ dinner; a casual affair typically held down by the lake. This year's event, however, was rained out and we congregated in the new business school's lounge. After dinner, and a few pints of excellent English beer, the traditional 40-question quiz from Paul Willmott, VP9MU, was given by Ken Eaton, GW1FKY. Team AMSAT-DL walked away with a slim victory, owing to their lone knowledge of arcane satellite operating system programming.

Presentations continued on Saturday, starting with nostalgic anecdotes from Peter Gulzow, DB2OS, and continuing with an informative update on the P3E program. Next, Fred Kennedy, ZL1BYP, presented the concept, status, and plans for KiwiSAT. Fred won the Best Speaker award for his presentation. Many more interesting



The SSTL operation employs a typical amateur V/UHF Yagi array plus a 3 m dish for S-band downlinks.



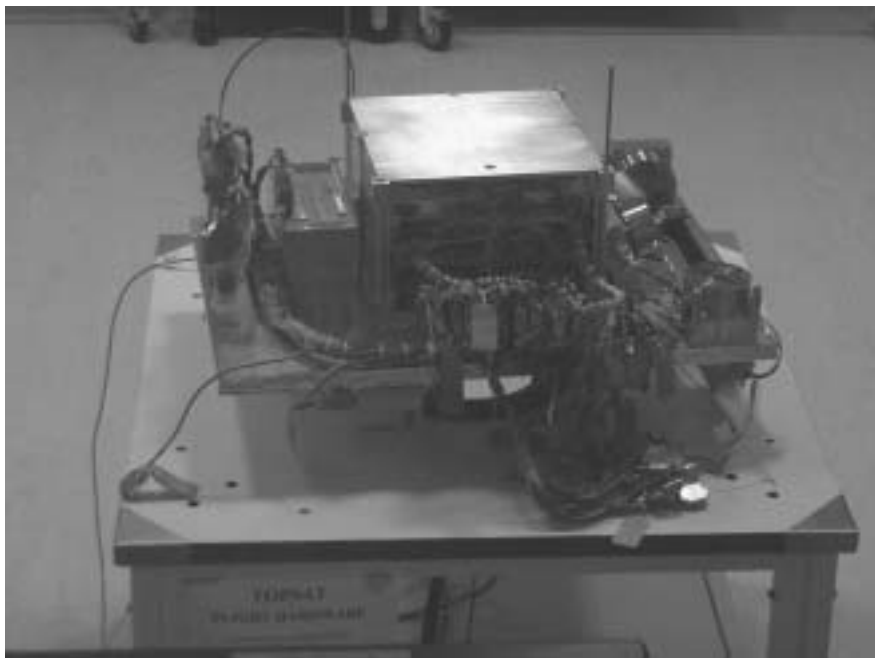
G7UPN explains the workings of the SSTL Satellite Command Center.

presentations filled the day, including an impassioned talk by Carlos Eavis, G0AKI, about the value of GB4FUN in getting school-age children interested in communications. Carlos won the Best New Speaker award.

Another attraction at the Colloquium is the equipment testing for S-band downconverters. I watched Sam Jewell, G4DDK, test a wide assortment of Drake, Transystem, and CalAmp downconverters, plus a few unusual ones from Italy and the elusive “Gemini” from David Bowman, G0MRF. The Gemini is an innovative design by David and Sam utilizing a 28 MHz IF and proving out with 38 dB of gain and 0.55 NF: best of the show. Sam and David also ran the antenna range, dodging in between the showers, and testing quite a few patch antennas, including my own dual-band 18" DSS dish system. You can see the results of the testing at: <http://www.btinternet.com/~jewell/satellite.htm>.

The highlight of the sessions for me was the video presentation by Rolf Niefind, DK2ZF, from his recent DX-experience as T88ZF and V63ZF. He showed us great film excerpts of his trip—from departure, through operating on beaches in the frequent rain showers, and finishing up with details of his “next” portable system for his planned DX-pedition in 2004.

Saturday evening brought the gala dinner and it was a truly fun event. I had the opportunity to spend several hours chatting with people, with whom I can normally only speak with on AO-40. Several awards were presented and the raffle for an FT-817 was won by JA1OGZ. The high point of the evening fun was the impromptu raffle of DB2OS's coveted “P3E Express” T-shirt.



(top) The TopSat flight hardware module sitting in the SSTL integration room with all of its wiring harnesses and internals exposed.

(middle-left) G3WDG describes his successful 24 GHz station setup.

(middle-right) The GB4FUN mobile radio shack sports a complete compliment of HF, V/UHF, and S-band antennas. Inside were a TS-2000B, IC-821H, IC-746, and FT-840, plus a 1 KW HF amplifier and the omni-present computer for logging, satellite tracking, and full control of the Kenwood TS-2000.

(bottom) VE3FRH leaving GB4FUN after the impressive beginner session. Can VE3FUN be far behind?



I departed early Sunday morning so I missed the last day's events, but I understand AMSAT-NA President VE3FRH, Robin Haighton, gave a fine opening address and update on ECHO. G6LVB presented his just-developed Las Vegas Boulevard Tracker based on a PIC microcontroller and sporting a USB interface. You may have seen pictures of Howard driving around in his convertible with the small dish automatically compensating for azimuth—the LVB Tracker has a GPS interface! Many more pictures are available at: <http://www.uk.amsat.org/colloquium/colpix03.htm>. ■



(top) G4DDK testing a modified Drake 2880 with the HP noise-figure meter.

(middle) The S-band antenna range was, unfortunately, outdoors. G4DDK is holding the author's 18" DSS dish and G0MRF is handling the 10 dB reference horn.

(bottom-left) ZL1BYP, holds up a KiwiSAT mock-up complete with antennae extended.

(bottom-right) The AMSAT-DL team, victorious in the annual space quiz: (L-R) DB2OS, DG1EFR, DK2ZF, DH2VA, DC3ZB





Nori A22BP in Botswana operated portable for 4 days in July in order to work the Americas. He normally operates from an east-facing apartment balcony



Continued from Page 16 ...

VK9C (Cocos-Keeling). October 11-23.
The Christmas Island team also plans to operate from Cocos-Keeling. Short windows will be possible for U.S. hams west of the Mississippi River.

T33 (Banaba Is.) April 2004
Doug Faunt N6TQS plans to operate AO40 as part of a major DXpedition to this extremely rare entity. Other rare entities may be activated on the way to and from Banaba Island.

Other DX operations are tentatively planned for September and October, but were not confirmed before this column was submitted. The flurry of DX activity is likely to slow down dramatically at the end of October when AO40 goes into its seasonal period of unfavorable alon/alat.

Please send reports of planned future DXpeditions to w9ae@amsat.org. Feel free to contact the author if you are interested in satellite operation from a rare country and want operating tips or loaner equipment.

Continued from Page 3 ...

satellite communications. Be sure to bring membership forms!

Some people want to experience what it's like to actually build a satellite. I receive many requests from people who want to help. The best way is to pick a device or sub-system or other task you think you can accomplish and just start working. If it looks good, you will automatically be part of the team. That's how the teams are formed – we don't create teams and send out assignments.

So to conclude my first Apogee View I would like to thank you, the members of AMSAT, for allowing me the opportunity to serve. And please help out any way you can – AMSAT needs YOU! ■



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